

Ohio Agricultural Experiment Station.

BULLETIN 77

WOOSTER, OHIO, FEBRUARY, 1897.

THE CHINCH BUG

AND

OTHER DESTRUCTIVE INSECTS.

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BULLETIN.

OF THE

Ohio Agricultural Experiment Station.

NUMBER 77

FEBRUARY, 1897.

THREE YEARS' STUDY OF AN OUTBREAK OF THE CHINCH BUG IN OHIO.

As compared with Illinois and the states west of the Mississippi and north of the Arkansas rivers, Ohio had, until 1895, never witnessed an outbreak of chinch bug. As a consequence, almost the only farmers who had any acquaintance whatever with the pest, were such as had had experience with it in the states above mentioned, few others being able to recognize it when it appeared in their fields. There had been a slight attack in extreme southern Ohio in 1873, and a more severe one, located more centrally, in 1887 and 1888, but even in these cases the ravages were not severe, except locally. In traveling about over the state, I have frequently observed it in limited numbers and learned of its previous occurrence in various localities, in noticeable though not in destructive numbers, from people who could only describe them as "being present at harvest time and among corn at the time of cutting and curing the fodder, and having the odor of bedbugs." It was, therefore, with little concern that in the summer of 1894 I noted them in limited numbers over the area indicated in Fig. 1, by horizontal lines, and much more abundant where these are crossed by oblique lines. There did not appear to be any special danger, and the threatened outbreak would probably have failed to materialize had the spring of 1895 been one during which there was an average rainfall. But the season of 1895 proved a very dry one, and I fully expected trouble from somewhere, but, up to June 25, no complaints were received from farmers, and I came to the conclusion that Ohio was certainly not a locality at all congenial to chinch bugs. Within two weeks, however, that opinion was entirely reversed, and hundreds of farmers appeared to discover the pest on about the same dates, and a perfect deluge of letters came pouring in; but strangely enough, very few of them came from within the area where the pest had been observed the previous year, and consequently where they might apparently be the most confidently expected. In Fig. 2, the area of attack and the relative severity are indicated as in Fig. 1, and it will be observed that in one county only, Wyandot, was the attack as severe as during the preceeding year, while over a considerable portion of the

area where bugs were observed in limited numbers in 1894 we had no complaints of their appearance at all in 1895.



FIG. 1. Map showing distribution of Chinch Bug in Ohio in 1894. Horizontal lines indicate area over which the bugs were found in limited numbers. Where these lines are crossed by oblique lines they were injuriously abundant.

Attention is here called to the isolated localities of occurrence that year, as these will prove of especial interest when we come to study the outbreak of the year 1896, besides indicating localities where we distributed the chinch bug fungus, *Sporotrichum*. The autumn of 1895 was very dry, and almost the entire fall brood of chinch bugs must have gone into winter quarters in a healthy condition. The spring of 1896 opened with a moderate rainfall, except in the extreme southern portion, where very few chinch bugs had been reported last year, so that it was, early in

the season, utterly impossible to foresee what was to follow, whether we were to have a third attack or not, and in case we did, where in the

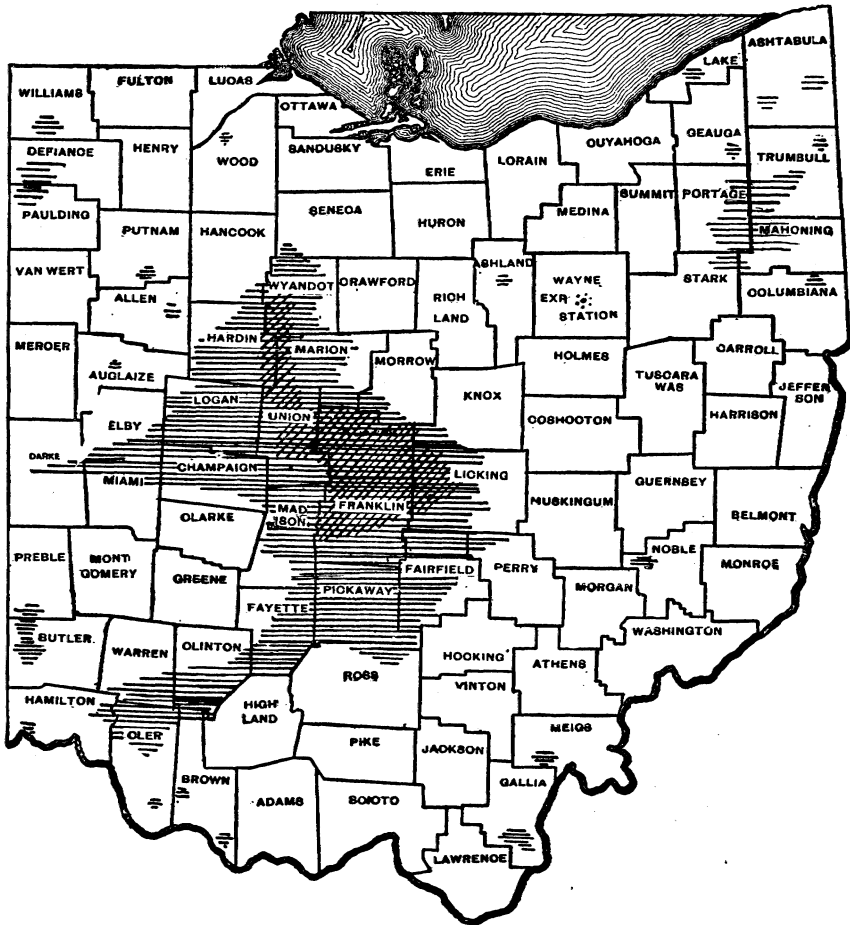


FIG. 2. Map showing distribution of Chinch Bug in Ohio in 1895. Horizontal lines indicate area over which the bugs were found in limited numbers. Where these lines are crossed by oblique lines they were injuriously abundant.

whole state we were to expect the outbreak. Farmers were apprehensive of trouble and very uneasy, especially where they had felt the effects of the ravages of the pest the year before, and to see a chinch bug on their premises was a signal for a call for aid in fighting what it was felt would, if not checked, prove even more destructive than last year. At least two farmers committed suicide on account of these troubles.

We had distributed about 750 packages of *Sporotrichum globuliferum* last year, 1895, and notwithstanding that there seemed little hope of re-

lief from this quarter, in case the drought continued, we were overwhelmed with applications for diseased chinch bugs. A change is cer-



FIG. 3. Map showing distribution of Chinch Bug in Ohio in 1896. Horizontal lines indicate area over which the bugs were found in limited numbers. Where these lines are crossed by oblique lines they were injuriously abundant.

tainly coming over the agricultural classes, in their feeling toward applied entomology, as is witnessed by the fact that, until quite recently, when there was an outbreak of any destructive insect the farmer would simply watch the destruction of his crops with helpless concern, whereas, now, he writes to an entomologist to send him some kind of disease or parasite that will destroy his enemy without further effort on his part.

To supply the demand for *Sporotrichum* it was grown on a mixture of beef broth and corn meal, and in this way we have this year responded to

over 1,200 requests. I mention this as indicating the fact that this year farmers were on the watch, and occurrences that in other years would have either escaped notice entirely or been ignored in case they were observed, were promptly reported to us, and will be found indicated on Fig. 3, in the same manner as on the other maps. About the 10th of June we were relieved of all suspense, and it was very clear that southern Ohio would be the area ravaged this year. The reason for this is not hard to find, as up to about June 10, very little rain had fallen in that section, and I take it that, by this time, the young bugs had so far developed as to be little, if at all affected by it. This will, in some degree at least, solve the problem of the appearance of the chinch bug in the south in such destructive numbers, this year, while the country farther north, where the hatching takes place later, escaped with little or no destruction to farm crops, except in the extreme northeast. But the perplexing feature of the problem is in that we have them this year in greatest numbers and committing the most serious depredations, for the most part, where we heard little or nothing at all of them last year. During these three years this pest has not seriously ravaged the same area twice. The nearest to come thereto is northeastern Ohio, in Ashtabula, Trumbull, Portage and Mahoning counties, where considerable damage was done in meadows last year, and fully as much, if not more, is being caused this year. (See Fig. 3.)

The immunity from attack of chinch bug continuously enjoyed by Clark, Greene and Montgomery counties, as also portions of other counties adjacent, I find it impossible to account for. The map of elevations, Fig. 4, plainly shows that elevation was not responsible, as practically the same elevations obtain in the extreme northeast, where destruction has been caused during both of these years. More than that, the former area includes a section of level prairie country between narrow belts of timber, that has never been wooded in the history of its occupancy by the white man, and is the very place of all others where the chinch bug might be looked for during years of abundance. Meteorological data throw no light whatever upon the problem, and I am forced to content myself with simply placing the facts upon record, leaving a solution of the puzzle to the future.

The continued ravages of this pest in Ashtabula, Trumbull, Mahoning and Portage counties, is even more perplexing, and its habits here differ radically from what are accredited to this species over the entire western country. Here, again, elevation offers no aid, as it does not differ materially from that of the unaffected area of which mention has just been made, and, besides, the much more closely situated counties of Summit, Medina, Wayne and Starke, which have so far also escaped attack, have very nearly similar elevations. Precipitation or wet weather could hardly be expected to account for the unique features of this portion of the problem, and I cannot find any indication of such influences. An

meadow. Two or three cases have come to my notice where the attack was begun on one side of a meadow last year, and a part destroyed, ravages beginning this year where ceasing last fall, and being carried on until the remaining portion had been destroyed. At wheat-harvest, instead of going from a wheat field to corn, as is usual elsewhere, the migration is, apparently, to meadows, and I am unable to find that any material injury has been done to corn in this section of the state, and have found the bugs in corn fields but very rarely, if at all. That the species is here less nomadic than elsewhere is also indicated by the abundance of individuals of the short-winged form, fully 10 per cent. of the adults, in August, having this character, so rarely found elsewhere to the south or west. In attacking timothy (blue grass and clover are left untouched) no attention is paid to either leaves or stem, the bulb only being attacked so that one may pass through a meadow literally alive with bugs and not see a single one, but, on drawing away the dead leaves and rubbish, the surface about these bulbs will be found as thickly populated as a small ant hill.

As an indication of the gregarious habit being retained by the adults, instead of scattering, as is usual elsewhere, as soon as wings are obtained, a meadow is not attacked throughout at the same time, but the bugs appear to move in compact bodies, and one may see the uninjured portion clearly defined, the edge taking on a slight tinge of yellow, then yellowish brown, followed by the thoroughly browned and dead grass, all within a space little more than a yard in width and stretching away in an irregular course across the field, in much the same manner as is to be witnessed in other portions of the state when bugs migrate from a wheat field to an adjoining corn field.

So far as temperature is concerned, this portion of Ohio belongs with northwestern Pennsylvania, western New York, and the southern half of Ontario, Canada, an area over which the chinch bug is supposed to be comparatively rare, even southern Michigan and northern Indiana being so far exempt from its ravages. This would place northeastern Ohio on the extreme northern border of the country occupied by the species, and would lead us to suspect that if it ever does break out in Canada in destructive numbers it will be found to ravage the timothy meadows more than elsewhere.

I have always held to the opinion that the parasitic fungus, *Sporotrichum globuliferum* could only be used, in a manner to offer relief to the farmer, during wet seasons, and where there was a superabundance of the host insect, and, though I have been severely criticised, am of this opinion still. For years I have been waiting such a combination of conditions, as they do not often occur, owing to the fact that wet weather during the hatching season is fatal to a large per cent. of the young, but not until the present year have my hopes and desires in this direction been gratified. To learn that a measure will fail under adverse conditions is

but half satisfactory, and before one can feel at all satisfied, the same measures must be tested under favorable conditions. This year I can say that, with all conditions favorable, *Sporotrichum globuliferum* has done all that Professor Snow or any other entomologist has claimed for it, but under conditions as adverse as these have been favorable, the results will prove quite the reverse. While I do not find any reason for the immunity from attack, this year, over the area where this fungus was distributed last year, believing that this can be accounted for by peculiar meteorological conditions, it saved farmers thousands of dollars where it was used the present season. Where applied early in June, though it did not save the wheat crop, it did in many cases so reduce the numbers of bugs before they had advanced far into the cornfields that they were rendered powerless. In wheat fields, where an early application was made, the furrows and other depressions in the surface were soon white with diseased bugs, and in the mellow ground of the cornfields a slight displacing of the upper surface with the foot would reveal myriads of their dead bodies intermixed with the soil. One farmer told me that upward of 1000 neighboring farmers had visited his fields, to secure dead bugs to place in such of their own fields as were infested, and I have myself seen good results from this method of introduction, taking pains to compare the conditions in such fields with those existing where *Sporotrichum* had not been introduced, and where careful search failed to reveal its presence.

While the practical value of this fungus has, in past years, probably been over estimated, it is to be regretted that there is at present a tendency to rush to the opposite extreme. Statements to the effect that it is of no value to the farmer, or that artificial introduction is useless, as when the conditions are favorable it will appear in a natural manner and do its work, are, to say the least, ill advised and true only under certain conditions. It is worthless to the farmer during a period of drought, or when the bugs are scattered, but it is practical and effective under conditions the reverse of these. It will sometimes appear in the fields in a perfectly natural manner, but this is uncertain, and we have here only one of many instances where science can and does facilitate and accelerate the usually slow mechanism of nature.

THE OUTLOOK FOR 1897.

While it is certain that the chinch bug has wintered over in vast numbers, throughout many portions of the state, this fact of itself does not necessarily imply another outbreak the coming summer. Everything may be said to depend upon the weather, during the breeding season. With frequent drenching rains during May and early June, no trouble need be expected, but with dry weather during this period, we may look for a reappearance of the pest. But with the experience of

the last three years upon which to base our expectations, it will be seen at once that no one can say where the trouble may not break out. Farmers have reported the bugs wintering over in corn shocks, in the woods among the moss on trees, and we know that the matted grass and weeds along the roadsides and hedges are favorite hiding places. Where corn shocks have been drawn in, or fed to stock in the barnyard or field, the most of the dormant bugs have doubtless become scattered out over the ground, and it is likely that a very large proportion of them will have been destroyed. Millions more may be killed by burning over the roadsides, fence corners, leaves in the woods and other similiar places of hibernation. Besides this, there is another measure that I have long wished might be tried, and that is the sowing of small plats of millet in damp places about the fields as early as possible, in order to bait the females there, and if possible induce them to deposit their eggs there, instead of in wheatfields. I have often observed a single pair of these bugs about a hill of young corn, and later found the young in the same locality, and it does seem possible to enlarge upon this feature of the insect's habits, and make some place or places so attractive to them that they will be drawn off from the fields to oviposit, when these plats of growing millet can be plowed under and the pest destroyed in this manner. Whatever the outcome, we shall endeavor to aid the farmers of the state in dealing with this pest in the most practical manner, whenever and wherever it may appear.

Though the fungus distributed by us last summer aided very materially in destroying these bugs, and, in southern Ohio, certainly saved many fields of corn, our ability to aid farmers with this disease was more a matter of weather conditions than anything else. With dry weather prevailing during the breeding season, and on to about the latter part of June, less assistance may be expected from this source than we were able to extend last summer, under conditions the reverse of these and favorable for the use of this fungus.

The question has already come up as to the probable effect of the very low temperature of the latter part of January on these insects. I will only say that the cinch bug will stand a much lower temperature during winter and apparently not suffer the least inconvenience therefrom.

SOME DESTRUCTIVE INSECTS THAT NEED TO BE
WATCHED FOR IN OHIO.

The species to which this portion of the Bulletin relates are, all of them, of foreign origin, and though all are not known to occur in the State at the present time, all may sooner or later be expected to make their way to within its borders. Therefore, the Bulletin is largely a message of warning to the people, and intended to put them on their guard against enemies that, when they do appear, will not be easily and promptly recognized. Indeed some of them have been present for several years, and are not even yet detected promptly and with certainty by those whose interests they affect. It may be said of all of the following that their appearance in Ohio at any time need surprise no one :

THE SINUATE PEAR BORER,

Agrilus sinuatus Oliv.

Ord. COLEOPTERA ;

Fam. BUPRESTIDÆ.

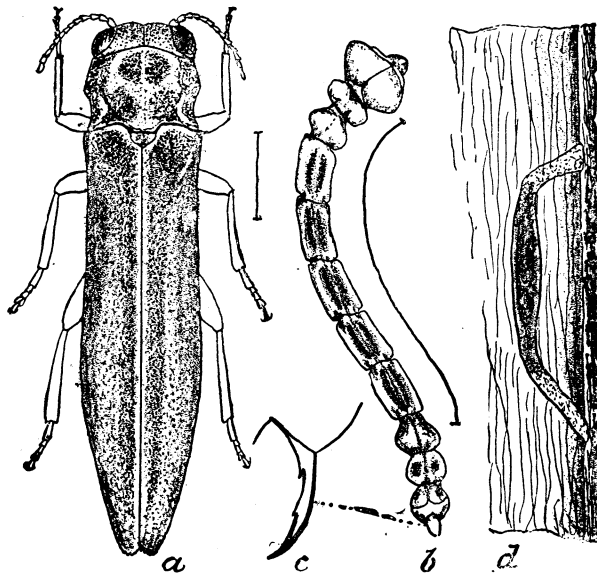


FIG. 5. The Sinuate Pear Borer. *a*, adult; *b*, larva or young; *c*, fork at posterior end of same; *d*, chamber in which the adult transforms.

This insect, though of foreign nativity, is closely allied to the Red-necked *Agrilus* which causes the gouty gall of the raspberry, treated in Bulletin No. 45, of this station. It is known to inhabit France and

Germany, a variety (*Chryseis* Curt.,) ranging over Central Europe. The adult was described in 1790 as being found on fruit trees, and while the name, *sinuatus*, was, without doubt, applied to the sculpture of the margins of the thorax, it applies equally well, if not even better, to the peculiar winding channels made by the larva or grub in the bark of trees attacked, as shown in Fig. 6.

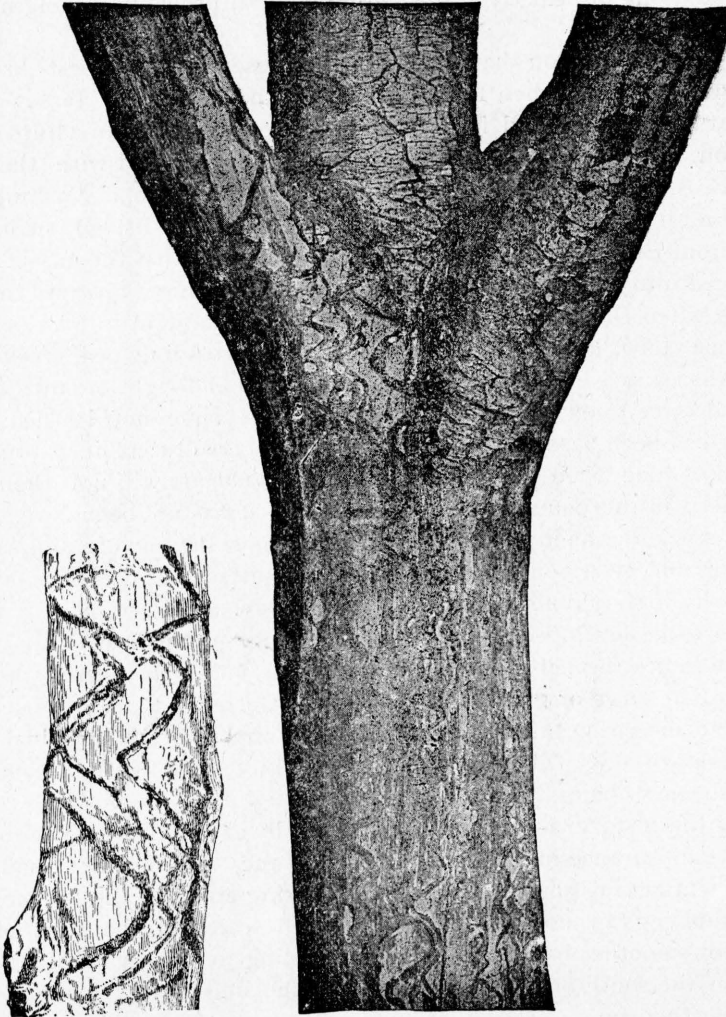


FIG. 6. Showing the burrows in Bartlett Pear at right, and trunk of smaller tree at the left.

It would appear that even in Europe its ravages are comparatively recent, or else have remained unobserved, as nothing, so far as we know

was recorded in regard to its habits up to 1883, when a French gentleman, Dr. A. Puton, called attention to its destructive habits, and stated that it had been injurious for twenty years, and so troublesome had it become in his district that it was almost impossible to secure healthy trees, all others living along for from six to ten years but finally succumbing to the attacks of this borer. In Germany we know of no record of the destructive tendencies of the species prior to 1890, when there was a sickening and dying of pear trees affected by a larva, probably belonging to this species.

The first intimation that we had of the presence of the pest in this country was in 1894, when Prof. John B. Smith, of the New Jersey Experiment Station, received information of its depredations in a nursery at Irvington, N. J., and then only after rearing the adult and with the aid of Mr. E. A. Schwartz, of the Department of Agriculture at Washington, identifying it as a new pest, added to the already long list of such, imported from Europe. Prof. Smith is quite confident that the insect was introduced into this country in pear stocks from France, received about the time when Dr. Puton speaks of its being so abundant in his locality. In August, 1895, Mr. Smith stated that it was destroying pear trees over a limited area in New Jersey, and that for \$5,000 and right of entry only, he would agree to extirminate it in his state. I have not learned that his offer has been accepted, yet I know perfectly well that it is only a question of time when it will reach Ohio and \$500,000 will not then extirminate it in this country. So far as known it has not been spread in nursery stock, but as it passes the winter in the solid wood in a dormant condition, and even young nursery trees are attacked, there seems no reason why it should not be sent out in this way.

The fully developed insect is shown in Fig. 5a, the line at the right of figure indicating natural length, while the color is shining bronze-brown. The larva or grub is shown at b, of the same figure, the length being also shown by line at right, while the anal fork on terminal segment is shown at c. The color is white, slightly tinged with yellow, the tips of the jaws being brown.

The life history, as at present known, is as follows: The beetle makes its appearance in late May or early June, a little later than our raspberry attacking species, and like it sporting about in the hot sun, depositing its eggs in crevices or under small scales in the bark of the smaller or smoother barked trees, and according to observations in Germany, on the south or southwest side for the most part, thus showing somewhat the same selection as our common apple tree borer, *Chrysobothris femorata*. The eggs hatch very slender, white larvæ, which Prof. Smith found to always work downward, leaving brown, thread-like burrows in the sap-wood. As the larvæ get older and larger the burrows become broader, first sinuate and irregularly bent and later on more zigzag, as shown in figure 6, this being a most perfect likeness of the

original, which I saw in Prof. Smith's laboratory last summer. The first year the work of the larvæ is scarcely visible, outwardly, on the tree, or the effect on the condition of the same. Late in the fall the larvæ cease to feed and become dormant, remaining in this condition until early spring, when they again begin their work, the channels now becoming visible on the outer surface in the form of abnormal splits and crevices, which are discolored and blackened, quite different in appearance from the normal pear bark.

In the matter of remedies for this pest, very little appears to be known. If much affected, burning will probably be the most satisfactory. It appears to me that if oviposition is confined to the sunny side of the trees, shading these might prove a repellent. The recommendations given out in Germany are to use a mortar of clay and cow dung, held in place by some cheap fabric, and retained throughout May and June. I am exceedingly anxious to have this reported as soon as it is observed in the state, which I hope will be a long time in the future, yet shall not be at all astonished to receive it at any time.

THE PEAR MIDGE.

Diplosis pyrivora Riley.

Ord. DIPTERA.

Fam. CECIDOMYIDÆ.

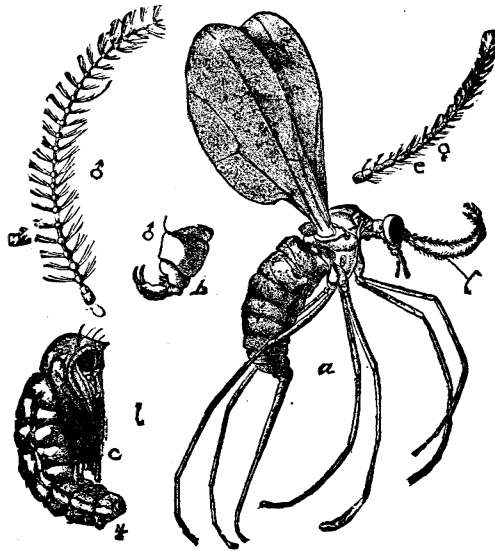


FIG. 7. The Pear Midge. *a*, the adult female; *b*, genitalia of male; *c*, pupa, all enlarged; *d*, antenna of male; *e*, same of female, more enlarged.

So far as habits are concerned, this species has nothing in common with the preceding, and a glance at figure 2, of Plate IV, will show at once that there is no relation existing between them. Both are, however, imported species, both attack the pear, and both were probably introduced into this country from France, with pear stocks. The Pear Midge attacks the fruit and not the tree, and is allied to both the Clover-seed Midge, *Cecidomyia leguminicola*, and much more closely to the Wheat Midge, *Diplosis tritici*.

The first information we have of this pest, in America, was in 1879, when its effect on the fruit was observed by the Messrs. Coe Brothers, at Meriden, Connecticut. The trouble increased to such an extent that in 1884, the attention of C. V. Riley, then U. S. Entomologist, was called to the matter. In 1888 the Coe Brothers attempted to stamp out the pest in their orchard by picking off and destroying the whole crop, but before this task was completed, a heavy rain set in and caused the fruit to crack open, releasing the larvæ, which at once entered the ground and the insect appeared the following year in still greater numbers, and has continued to spread until it now extends southward into New Jersey and westward into New York as far as Albany, so that it seems but a question of a very few years at farthest when it will reach Ohio.

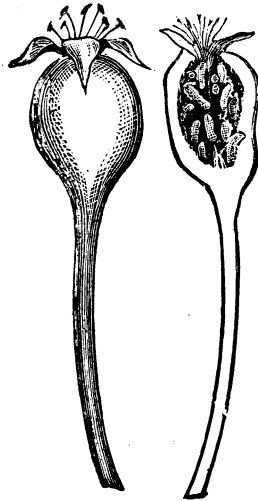


FIG. 8. Showing young of Pear Midge in young fruit.

The assumption that this is an imported species is based upon the fact that it appears to be identical with a species described by Meigen, and observed in Europe as early as 1830, by Schmidberger, attacking

pears precisely as in this country, though the types seem to have been lost and the descriptions are inexact in some respects. The Coe Brothers saw nothing of it until subsequent to a large importation of pear stocks from France, in 1877, and the spread since has been traced directly from this locality, and it does not occur elsewhere than over this area, in any part of the country. The insect develops in the young fruit, and transforms to the adult in the ground, and was supposed to have been first brought to America in earth among or about pear stocks.

The adult midge, shown at Fig. 7*a*, is a small grayish-colored fly with delicate wings, long legs and rather slender body provided with a long ovipositor by which it places its eggs in the opening blossoms of the pear, sometimes puncturing the calyx to do so and sometimes not. Prof. Smith concluded that she inserted her ovipositor into the buds wherever she could do so the most easily, and that it is a matter of total indifference where, in the blossom, the eggs are placed. The eggs hatch to small, pale yellow larvæ or maggots, which make their way downward into the young fruit, eating out a central cavity as shown at right in Figure 8, and causing the fruit to also grow in a distorted shape, as illustrated in Fig. 9. Strangely enough, the affected pears do not drop off

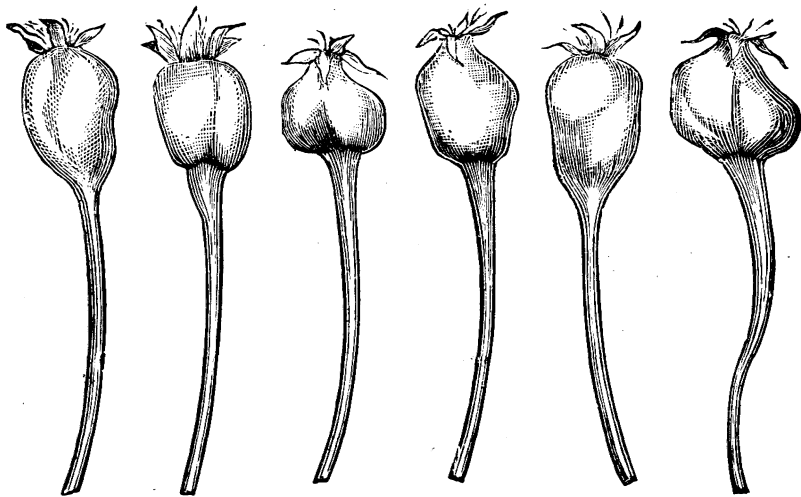


FIG. 9. Showing effect of Pear Midge in distorting young fruit.

but remain on the tree, cracking open and allowing the maggots to escape to the ground, into which they enter, and constructing a cocoon of yellowish silk, and sand or soil, according to Dr. Lintner, pupate in the fall, emerge as adults, probably at a time corresponding to the opening of the bloom in spring.

It will be seen that, though it is possible to at once detect infested fruit on the trees, to collect and destroy all such is impossible over the extended area where it is now known to occur. The golden opportunity to stamp out the pest, in this way, has passed. It is likewise impossible to reach the larvæ or eggs, unless some method of treating the soil is found, whereby the maggots can be destroyed before forming their cocoons, as it is hardly practicable to reach them afterwards. Prof. Smith thinks he has found marked results in the application of kainit to the soil beneath the trees, after the maggots have taken refuge there, and before they have constructed their cocoons, but as yet this has not been thoroughly enough tested to warrant positive statements. It is, however, to be hoped it is effective, as kainit would be a fertilizer as well as an insecticide. Of the varieties attacked, the Lawrence appears to be preferred, but allied varieties are seriously injured, while the Kieffer and those allied either escape entirely or with little injury.

THE WOOD LEOPARD MOTH.

Zeuzera Pyrina Linn.

Ord. LEPIDOPTERA:

Fam. COSSIDÆ.

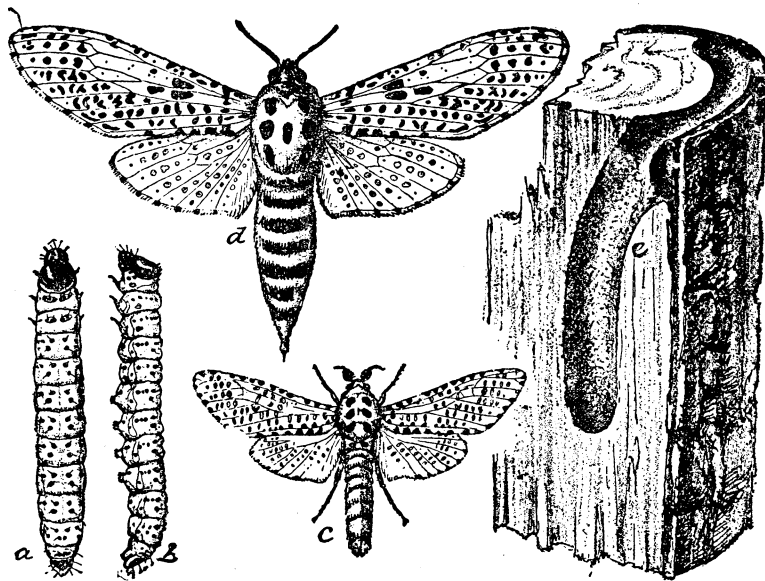


FIG. 10. The Wood Leopard Moth. *a*, *b*, larva, from above and side; *c*, male; *d*, female; *e*, larval burrow, showing tendency of the full grown larva to girdle its food plant.

This insect is shown in the illustration with more than ordinary exactness, the colors being white with black spots and the size as shown.

It is a native of Europe and England, attacking both fruit and forest trees, especially the shade trees in cities and in parks and private grounds.

It has been introduced into this country at one point only, so far as known, in the vicinity of New York City. The first knowledge we have of its appearance in America was in February, 1882, when a New York entomologist, Mr. Jacob Doll, reported that in June, of 1881, he had found a single moth in a spider's web at Hoboken, New Jersey. As the moth was alive, there could be no doubt of its having developed in this country. It is now supposed to have been brought over to this country in some portion of a ship's cargo, probably a few years prior to 1881, and has become fully established and spread over the closely adjacent country, including New York City, Long Island, a small portion of Connecticut and New Jersey. Professor Smith, of the New Jersey Experiment Station, stated two years ago that, owing to its ravages, there was hardly a sound tree to be found in Newark, and that it was seriously destructive in Irvington, Elizabeth and Arlington, and had probably reached Jersey City, Orange and Monclair.

Dr. E. B. Southwick, entomologist for the department of public parks of New York City, and who first observed it in the parks in 1884, pointed out its ravages to me in Central Park in 1895, and rated it as one of the worst, if not, indeed, the worst insect with which he was obliged to contend. On Long Island it has created much destruction among fruit trees, and there seems to be no good reason why it may not attack nursery trees and in them be conveyed to distant points, though as yet we have no knowledge of this having occurred. Curiously enough, electric lights bid fair to be one of the influences that affect the spread of this insect, this light having been observed to have a special attraction for the moths.

In this country, the moths make their appearance in May and June, continuing on through July and into August. The male moth, Fig. 10*c*, is much smaller than the female, Fig. 10*d*, the latter being heavy bodied and clumsy, the posterior extremity of the body being provided with a pointed, horny ovipositor. No one has as yet witnessed oviposition, but it appears probable that the eggs are pushed into cracks and crevices in the bark, and in case of trees with smooth bark this may be penetrated by the ovipositor and a cavity thus made for the reception of the eggs. The twigs and branches of large trees and the main branches and trunks of smaller trees are more apt to be selected. The eggs are small, oval and salmon-colored, each female being capable of depositing 300 or more eggs. The eggs are supposed to hatch in about ten days after being deposited, and the movements of the young appear to depend somewhat on the locality on the tree where the egg is laid. If the egg is placed on a small twig, the larva eats into the centre and then usually toward and as the twig gets

too small to accommodate its body it eats out and selects a more commodious limb and works its way into it; but if the egg is deposited on the trunk of a large tree the larva simply eats into the bark, seldom going beyond the sap wood the first summer and fall. The following spring, when the larvæ have the appearance shown in Fig. 10 *a* and *b*, being a little more than half grown, according to Prof. Smith, they may either burrow directly through the centre, eat almost half of the diameter of a branch, eat an irregular chamber in the trunk beneath the bark, or completely girdle the trunk or branch in which it may be working, as indicated in Fig. 1 *c*. This work continues until May, when a loose cocoon is formed in the burrow, close to the bark, and the larva changes to a yellowish-brown pupa, which, when ready to transform, works itself forward, cutting its way by the aid of a chisel-like protuberance through the bark and out far enough for the wings to clear the tree, when the moth bursts the chrysalis and emerges to the world. Thus it will be seen that the life of the insect covers two years.

Remedial measures are few and of doubtful utility. The insect is entirely beyond the reach of arsenical poisons or kerosene emulsion, and therefore spraying is useless. Dr. Southwick says that in 1893 himself and his men spent two months fighting this pest alone in the city parks, collecting wagon loads of limbs and branches and destroying larvæ and pupæ, and his methods are probably the best that can be suggested, viz: cutting off and burning affected branches, probing the burrows with sharp pointed wires and dropping bisulphid of carbon into the burrows and stopping the openings with putty. It is also proposed to place pans containing kerosene under the electric lights, so that such moths as are attracted by these may drop or fall into them and be destroyed.

It will be observed that this pest will be a most unwelcome one in Ohio, yet it is one that, to all appearances, wants only time to reach us, as there is little likelihood of its being stamped out in the east.

THE CABBAGE CURCULIO.

Ceutorhynchus rapæ Gyll.

Ord. COLEOPTERA:

Fam. CURCULIONIDÆ.

Up to the present time, at least, this has been supposed to be an imported species, whose original home was supposed to have been Middle and Northern Europe. I understand, however, that there is a probability of its being soon described as a new species, the change being based on what appear to be trivial characters, and such as a change of environment, and geographical distribution might easily account for. To those who study life in alcoholic specimens, nothing in the science of species making is impossible, and the slow and intricate development of a species, through the process of evolution, appears to have been unnecessary.

In our country it occurs in Canada, and from New York to Kansas, west of the Alleghany mountains extending as far south at least as Lat.

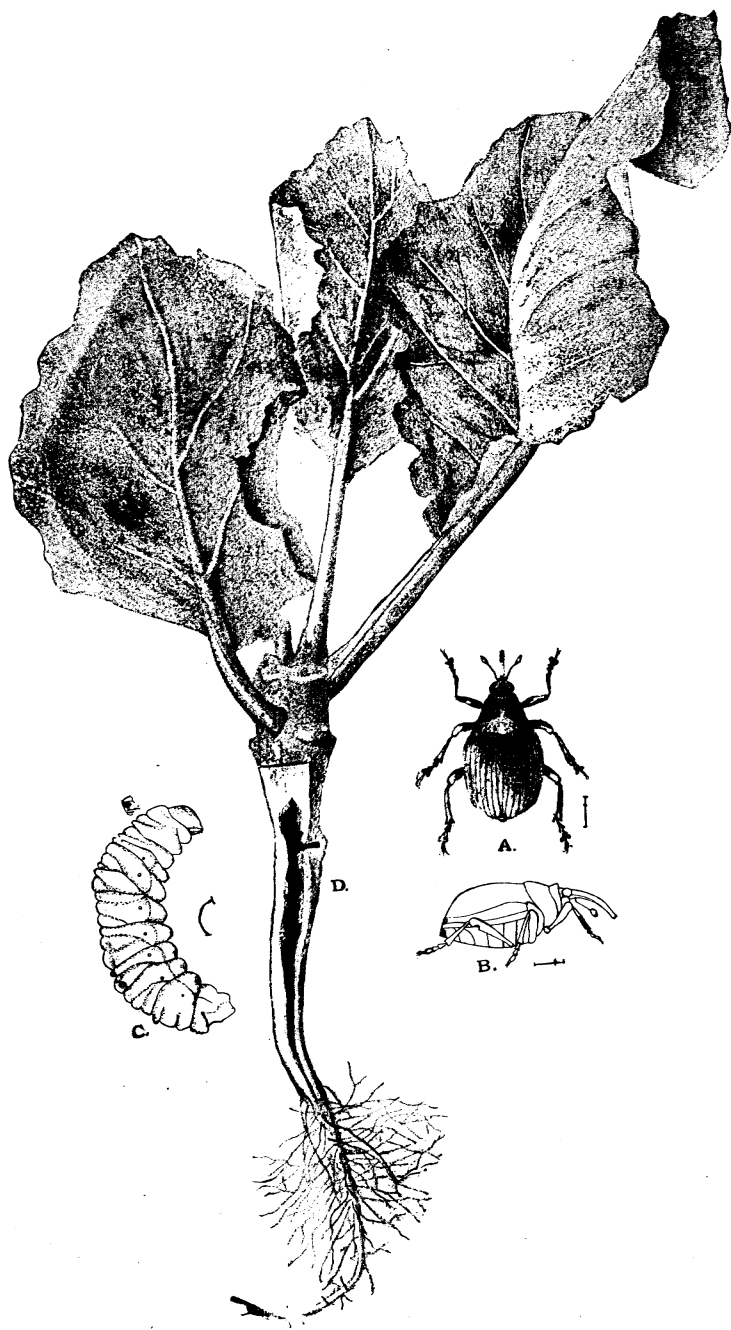


FIG. 11. The Cabbage Curculio. A, view from above; B, side view; C, larva
D, burrow made in young cabbage plant by the larva. □ Lines indicate natural length.

39°, and perhaps farther. I have found it quite common in Illinois, Indiana and Ohio, but never saw its depredations until in June, 1895, and in this instance working in but one locality, near Xenia, Ohio.

The first to observe its destructive habits in this country, so far as the writer is aware, was Miss Mary E. Murtfeldt, of Kirkwood, Missouri, who found it proving very destructive to young cabbage plants in hot-beds, at Glasgow, Missouri, in April, 1888. A recent letter from Miss Murtfeldt states that the insect still continues to commit these depredations in Missouri, and it also continues to depredate here in Ohio, it having again been brought to my notice as injuring cabbage about Port Clinton, Ottawa county, in May of 1896.

In Bulletin 30, U. S. Department of Agriculture, Division of Entomology, Miss Murtfeldt states that the insect also attacks cauliflower, in hot-beds and soon after the plants have been transplanted, but appeared to oviposit in its more natural foodplant a little later, as she found the young larvæ in pepper-grass, *Lepidium virginicum*, in July, but was unable to bring the insect through its transformations because of the foodplant not thriving indoors.

Our own notes on the species may be summed up as follows: Cabbage plants being grown in small beds in a field of low ground between Dayton and Xenia, Ohio, were found by Mr. A. A. Shoup to be attacked by larvæ burrowing in the stems late in May, specimens being received by me June 4th, and from these plants adults emerged July 18th, larvæ being also found in the burrows. May 8, larvæ were found in stems of pepper-grass at Waterville, Ohio, in northern part of the state, and also working some into cabbage about Port Clinton, as previously stated. June 6, Mr. Mally, to whom the study of the species was assigned, found dead larvæ in stems of pepper-grass at Wooster, but no living ones, though many plants were examined and the work of the larvæ, as was presumed, was found there with evidences that these had made their way out. June 10, somewhat smaller larvæ were found in these plants but they died soon after, evidently from some bacterial disease. Several larger larvæ were found, and one of these entered the earth provided for it in a breeding jar, but we failed to rear the adult, though close watch was kept over it up to June 25th. On the 16th of June, the adults were found quite abundantly on rape, and though kept upon this plant until nearly the first of August, oviposition was not observed, though the females were often seen in the act of puncturing the stems of the young rape plants with which they were provided. In confinement they also fed quite extensively on the epidermis of the leaves, in some cases devouring the young tender leaves so completely that nothing was left but mere shreds.

So far as remedial measures are concerned, it would seem that cutting off the pepper-grass plants in May, and probably in late July, might destroy so many of the larvæ as to offer some protection from their ravages in the garden.

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Entomologist.